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The Ericaceae in New Zealand (*Gaultheria* and *Pernettya*)

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Abstract

COMPARATIVE descriptions are given of each of the ten species of the family in New Zealand, together with a key, and notes on distribution and the occurrence of male-sterility. A diagram showing leaf shapes is also provided. One new species and one new variety are recognised. Hybridism is widespread and notes are given on the occurrence of all known hybrids together with two diagrams.

Gaultheria and *Pernettya* are the only genera of the Ericaceae indigenous to New Zealand. Hooker (1854) listed five species of *Gaultheria*, but later (1864) reduced one species (*G. colensoi*) to a variety, and added a species of *Pernettya*. Under the names *G. antipoda* and *G. rupestris*, he included a number of varieties, some of which are now regarded as species and some as hybrids. He described *G. fagifolia* from two specimens apparently of hybrid origin.

Cheeseman (1906) recognised five, and later (1925) six species of *Gaultheria* and one of *Pernettya*, the two additional species of *Gaultheria* having previously been treated as varieties of *G. antipoda*. He described all species in detail, but made the descriptions fairly general to include a number of variants.

Burtt and Hill (1935) revised the two genera in Australia and New Zealand, but did not give descriptions except for their own new species. They also reinstated Hooker's *G. colensoi* as a species and restored *G. perplexa* to the genus *Pernettya* where it had been placed by Colenso as *P. macrostigma*. They also recognised a number of *Gaultheria* and *Pernettya* hybrids. Their greatest contribution was in the examining of type specimens and the sorting out of synonyms.

I have examined all the material of the two genera in the Dominion Museum, and Botany Division herbaria (hereafter referred to as WELT and CHR respectively), as well as the herbaria of Auckland, Victoria, Canterbury and Otago Universities. Experience in the field is fairly extensive, but has not covered the south of the South Island or Stewart Island. Mass collections have been made at Rainbow Mountain (Rotorua), Tararua Ranges (Wellington), and on both sides of the Southern Alps.

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In this paper, descriptions of all species have been rewritten. In some cases this has proved to be merely an expansion of previous work, but in others, the species have been more closely delimited. Particular attention has been paid to the genus *Pernettya*. Seven species of *Gaultheria* are described, and three of *Pernettya*, one of which is a new species.

Hybridisation is widespread, and has been the source of much confusion. Each species has its own ecological niche, but where two or more overlap, crossing occurs quite freely. Hybrid plants are generally plainly recognisable because they lack uniformity and because they are usually fewer than the parents. From the number of hybrids listed below, it may be wondered whether the species are very distinct units. In practice they are clearly defined (with one or two exceptions), and can be readily distinguished.

Male-sterile plants are quite common in certain species, generally to the extent of about 30%. In male-sterile flowers, anthers are not formed, but the filaments develop normally except that their tips curl over. Male-sterility in *Pernettya* is accompanied by a very noticeable reduction in flower size, though this has not been seen in *Gaultheria*. Plants seem to set seed quite normally, so unless parthenogenesis occurs, cross fertilisation must be efficient. Burtt and Hill mentioned male-sterility only once, in connection with a hybrid of *P. nana*.

The New Zealand members of the Ericaceae are all shrubs. Flowers are regular, calyx five-toothed, corolla gamopetalous, five-lobed, lobes reflexed at the tips. Stamens 10, filaments free, anthers two celled, opening by terminal pores. Ovary five-celled, superior, about 1 mm high, style single and capitate. In *Gaultheria*, the fruit is a capsule, sometimes enclosed in a fleshy calyx; in *Pernettya* it is a berry, surrounded by the unchanged calyx. Taking the two genera as a whole, it seems that the nature of the calyx in the fruit is not a very reliable character, but it appears to be a useful character in the New Zealand species.

For ease of description the species of *Gaultheria* are here divided into two groups, though no firm taxonomic status is claimed for these groups.

Group A.

Shrubs over 0.5 m high, leaves generally large and thick. Inflorescence racemose. Pedicels 2–5 mm long with 2 bracteoles at the base and subtended by a bract on the peduncle. Bracts ovate, keeled, 2–3 mm long, bracteoles similar but smaller. Calyx pubescent within. Corolla 2–3 mm long. Filaments about 1.5 mm long, papillose, dilated near the base but then narrowed again below. Anthers about 0.8 mm long with short flaps and awns 0.3–0.4 mm long. Capsule included in the unchanged calyx.

Group B.

Shrubs of variable size, leaves less than 15 x 12 mm, flowers solitary and axillary. Pedicels with a number of bracts at the base, sometimes completely concealing the pedicel. Bracts ovate and ciliate. Calyx pubescent within. Corolla 2–2.5 mm long. Filaments about 1 mm long, papillose, dilated near the base but then narrowed again below. Anthers about 0.4 mm long, cleft, with minute awns up to 0.2 mm long. Capsule surrounded and enclosed by the enlarged and succulent calyx.

KEY TO THE NEW ZEALAND MEMBERS OF THE ERICACEAE

1. Fruit a capsule, with or without a fleshy calyx (*Gaultheria*) 2
   Fruit a berry, seated in the unchanged calyx, or calyx fleshy at the base (*Pernettya*). Flowers solitary 8
2. Flowers in racemes or panicles, calyx dry and unaltered in the fruit (Group A) 3
   Flowers solitary and axillary, calyx fleshy in the fruit (Group B) 7

3. Leaves opposite or nearly so, cordate at the base .... *G. oppositifolia*
   Leaves alternate, not cordate at the base 4
4. Leaves more than 2 cm long, at least twice as long as broad, not excessively thick 5
   Leaves up to 2 cm long, orbicular to oblong, very thick 6
5. Leaves 3–6 x 1–2 cm., oblong or elliptic oblong, rounded at the base .... *G. paniculata*
   Leaves up to 4 cm long and 1 cm wide, lanceolate, acute at the base .... *G. rupestris*
6. Leaves elliptic or elliptic-oblong, branchlets strigose, flowers mainly in axillary racemes. South Island .... *G. crassa*
   Leaves sub-orbicular, branchlets pubescent only, flowers in terminal racemes. North Island .... *G. colensoi*
7. Erect bush up to 2 metres, fruit up to 6 mm in diameter ..... *G. antipoda*
   Scrambling shrub, branchlets up to 20 cm long, fruit up to 12 mm in diameter .... *G. depressa*
8. Scrambling or semi-erect shrub up to 1 metre. Leaves linear, up to 12 mm long. Branchlets pubescent and sparsely setose. Filaments dilated near the base, papillose .... *P. macrostigma*
   Small matted shrub, branchlets less than 5 cm long, minutely pubescent only, or glabrous. Leaves elliptic, up to 7 mm long. Filaments ribbon-like and smooth 9
9. Leafy branches erect, leaves 3–7 x 2–4 mm, very thick. Pedicels about 1 mm long, margins of calyx segments membraneous and entire, anther cells without awns .... *P. alpina*
   Leafy branches erect or more usually prostrate, leaves 2–4 x 0.5–1.5 mm. Pedicels longer, margins of calyx segments ciliate, anther cells with distinct blunt awns .... *P. nana*

GAULTHERIA

Gaultheria oppositifolia Hook. f., Fl. N.Z. 1; 162, t. 43, 1854.

Brossaea oppositifolia (Hook. f.) O. Kuntze, Rev. Gen. 388, 1891.
Gaultheria multibracteolata Col. in *Trans. N.Z. Inst.* 24: 389, 1892.

A large shrub, 1 to 3 metres high. Branchlets without pubescence or setae. Leaves opposite, 25–60 x 15–30 mm, length seldom more than twice the width, sessile or almost so, cordate, ovate or ovate-oblong, very thick and coriaceous, mucronate at the obtuse apex, margins slightly thickened, bluntly serrulate, teeth mammilate, upper surface with or without a fine pubescence along the midrib together with a few bristles (or their bases in older leaves), otherwise glabrous and glossy, lower surface densely strigose, especially on the veins of young leaves, only the hair bases remaining on older leaves. Inflorescence of axillary and terminal racemes, the latter often compound forming broad terminal panicles with opposite spreading branches. Peduncle and pedicels glabrous. Corolla glabrous within.

DISTRIBUTION. Extending from Matamata in the north to National Park in the south, from East Cape to Mt Egmont, and also on Mayor Island. The stronghold of this species in the Rotorua-Taupo region. Sea level, 2,000ft. Flowers November-January.

This is a very distinct species, easily distinguished by the opposite and cordate leaves, and the glabrous stems. Hybrids with *G. antipoda* are very common and it is probable that the majority of specimens labelled as *G. oppositifolia* are in fact hybrids. They show practically every variation possible between the two parents, and as *G. oppositifolia* never occurs isolated from *G. antipoda,* it is difficult to delimit the species exactly. For practical purposes, it is usual to include those forms in which the stems have a few setae and the leaves are not quite opposite.

Gaultheria paniculata B. L. Burtt and A. W. Hill, in Journ. Linn. Soc. 49; 614, t. 1, 1935.

"Shrub. Branchlets scaly at the base, the scales passing gradually into the leaves, strigose; branches becoming glabrous. Leaves alternate,

elliptic or oblong-elliptic, 3–5 cm long, 1–2 cm wide, mucronate at the acute apex, rather abruptly narrowed at the base into a thick petiole 2 mm long, margins serrate, on upper surface glabrous except for small hairs on the veins, conspicuously reticulate, on lower surface sparsely strigose when young; more densely on the veins, becoming glabrous with age and armed with the hair-bases. Inflorescence of axillary racemes near the tips of the branches, often branched to form a terminal panicle. Axis of the raceme bearing very short stiffly spreading white hairs and, more sparsely, thicker brown hairs . . ."

DISTRIBUTION. Not uncommon on the Volcanic Plateau, extending to Mt Egmont, Pio Pio, Coromandel Range and East Cape. Sea level, 2,000ft. Flowers October-November.

The above description is a translation from that of Burtt and Hill. The species is best distinguished by its long narrow leaves, rounded at the base and typically oblong, but varying from elliptic to lanceolate. On the one hand it is closely related to *G. rupestris*, apparently replacing that species north of about latitude 39°, and on the other, to *G. oppositifolia*, this latter relationship recognized by Burtt and Hill. Figure 2 shows in a scatter diagram the many affinities with both *G. oppositifolia* and *G. antipoda*; only the high length:breadth ratio of the leaves distinguishes *G. paniculata* from a hybrid between these two last-mentioned species, from which it perhaps originated quite recently. Moreover it rarely occurs outside the range of *G. oppositifolia,* but because it is rather constant over a wide area it is regarded as a distinct species. Specimens from the Coromandel where *G. oppositifolia* is absent, usually have obovate or spathulate leaves, as do those from the Urewera.

Gaultheria rupestris (Linn. f.) D. Don in G. Don, Gen. Syst. 3; 841, 1834.

Andromeda rupestris Linn. f. Suppl. 237, 1781.
Brossaea rupestris (Linn. f.) O. Kuntze, Rev. Gen. 388, 1891.

A large shrub, 1 to 3 metres high. Branchlets pubescent and usually densely strigose, especially near growing tips. Leaves alternate, 20–40 x 6–12 mm, length usually three to four times the width, petiolate, oblong-lanceolate, elliptic-lanceolate, or oblanceolate, thick but not excessively so, mucronate at the acute apex, very acute at the base, margins more or less thickened, bluntly serrulate, teeth armed with bristles in the growing leaf, but bristles deciduous leaving short spikes, upper surface with pubescence and a row of bristles along the midrib, lower surface sparsely or densely strigose, veins conspicuous. Inflorescence of axillary and terminal racemes, often crowded at the tips of branches. Peduncle and pedicels pubescent. Corolla more or less pubescent within.

var. **subcorymbosa** (Col.) Burtt and Hill

Gaultheria subcorymbosa Col. in Trans. N.Z. Inst. 22; 476, 1890.
Gaultheria glandulosa Col. l.c. 28; 600, 1896.
Gaultheria calycina Col. l.c. 31; 274, 1899.

Leaves usually less than 30 mm long, elliptic-lanceolate, often fairly sharply serrate. Corolla glabrous.

DISTRIBUTION. var. *rupestris*. Along the West Coast of the South Island from Nelson to Fiordland, abundant on banks and slips, etc., up to 2,500 ft. var. *subcorymbosa*. From the Ruahine Range southwards to Cook Strait, from sea level to 4,000ft, but more plentiful as a sub-alpine shrub. Flowers November-December.

This species is best distinguished by the lanceolate or oblanceolate leaves, which are acute at the base. The type variety is fairly constant and virtually restricted to the lowlands of Westland. The only other species with which it comes into contact are *G. antipoda* and *P. macrostigma*. Hybrids are rare.

The variety *subcorymbosa* is most variable. In part this is due to the fact that it is often attacked by mites which alter the characters of the indumentum and

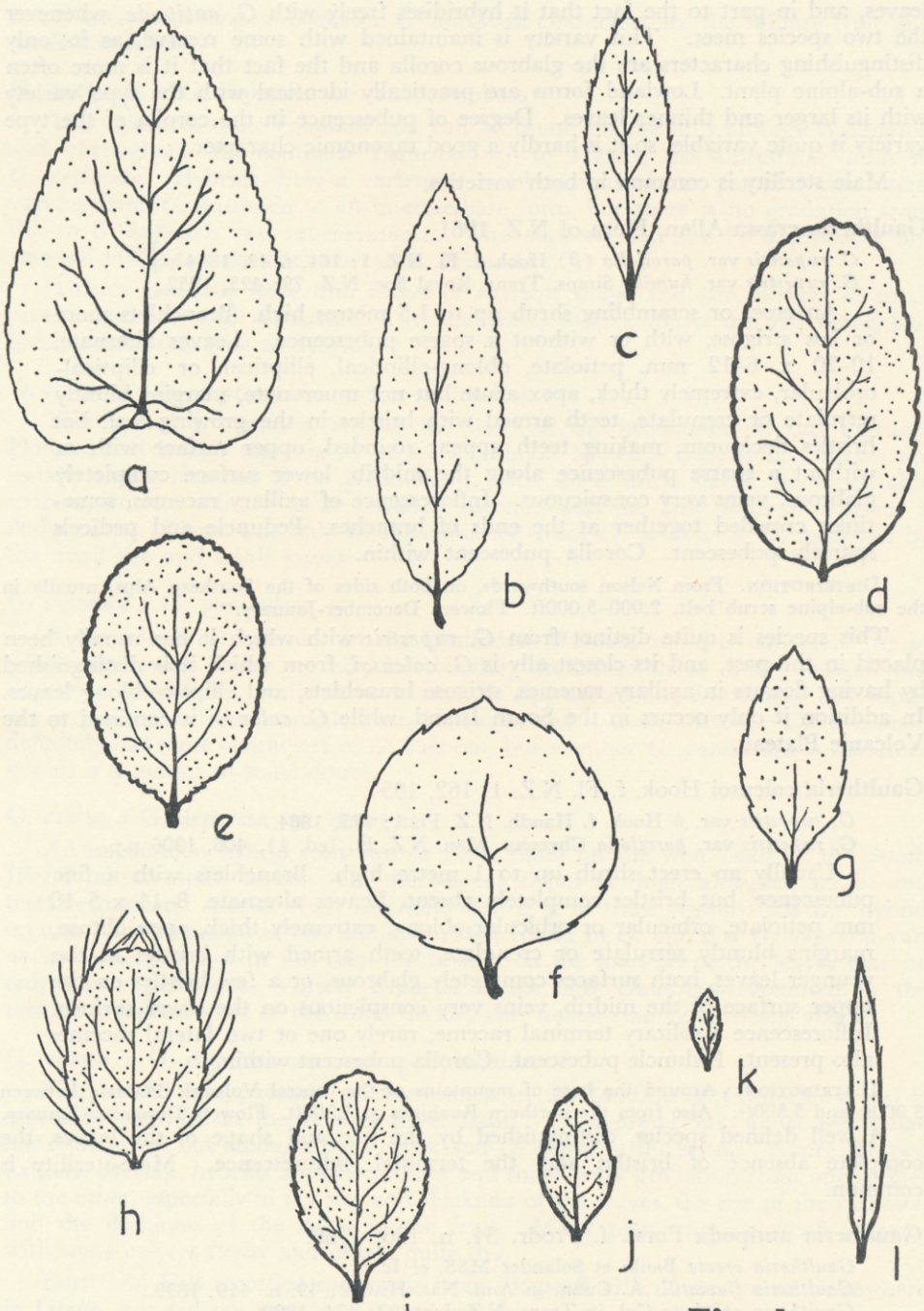

Fig. 1

FIG. 1.—Leaves (a) *G. oppositifolia.* (b) *G. paniculata.* (c) *G. rupestris.* (d) *G. crassa.* (e) *G. colensoi.* (f) and (g) *G. antipoda.* (h) *G. depressa* var. *depressa.* (i) *G. depressa* var. *novae-zealandiae.* (j) *P. alpina.* (k) *P. nana.* (l) *P. macrostigma.* (a) to (c) × 1; (d) to (l) × 2.7.

leaves, and in part to the fact that it hybridises freely with *G. antipoda,* whenever the two species meet. This variety is maintained with some reserve, as its only distinguishing characters are the glabrous corolla and the fact that it is more often a sub-alpine plant. Lowland forms are practically identical with the type variety with its larger and thinner leaves. Degree of pubescence in the corolla of the type variety is quite variable, so it is hardly a good taxonomic character.

Male sterility is common in both varieties.

Gaultheria crassa Allan, Flora of N.Z. 1961

G. rupestris var. *parvifolia* (β) Hook. f. Fl. N.Z. 1; 161, t. 42, 1854 p.p.
G. rupestris var. *humilis* Simps. Trans. Royal Soc. N.Z. 79; 423, 1952.

An erect or scrambling shrub up to 1.5 metres high. Branchlets more or less strigose, with or without a sparse pubescence. Leaves alternate, 10–20 x 6–12 mm, petiolate, oblong-elliptical, elliptical, or elliptical-orbicular, extremely thick, apex acute but not mucronate, margins bluntly serrulate or crenulate, teeth armed with bristles in the growing leaf, but bristles deciduous, making teeth appear rounded, upper surface with or without a sparse pubescence along the midrib, lower surface completely glabrous, veins very conspicuous. Inflorescence of axillary racemes, sometimes crowded together at the ends of branches. Peduncle and pedicels sparsely pubescent. Corolla pubescent within.

DISTRIBUTION. From Nelson southwards, on both sides of the Southern Alps, usually in the sub-alpine scrub belt, 2,000–5,000ft. Flowers December-January.

This species is quite distinct from *G. rupestris* with which it has usually been placed in the past, and its closest ally is *G. colensoi,* from which it is distinguished by having flowers in axillary racemes, strigose branchlets, and elliptic-oblong leaves. In addition it only occurs in the South Island, while *G. colensoi* is confined to the Volcanic Plateau.

Gaultheria colensoi Hook. f. Fl. N.Z. 1; 162, 1854.

G. rupestris var. δ Hook. f. Handb. N.Z. Fl. 1; 175, 1864.
G. rupestris var. *parvifolia* Cheesem. Man. N.Z. Fl. (ed. 1), 406, 1906 p.p.

Usually an erect shrub up to 1 metre high. Branchlets with a fine pubescence, but bristles completely absent. Leaves alternate, 8–14 x 5–10 mm petiolate, orbicular or orbicular-oblong, extremely thick, apex obtuse, margins bluntly serrulate or crenulate, teeth armed with bristles in the younger leaves, both surfaces completely glabrous, or a few bristles on the upper surface of the midrib, veins very conspicuous on the lower surface. Inflorescence a solitary terminal raceme, rarely one or two lateral racemes also present. Peduncle pubescent. Corolla pubescent within.

DISTRIBUTION. Around the base of mountains of the central Volcanic Plateau, between 3,000ft and 5,500ft. Also from the northern Ruahines at 4,500ft. Flowers December-January.

A well defined species, distinguished by the size and shape of the leaves, the complete absence of bristles and the terminal inflorescence. Male-sterility is common.

Gaultheria antipoda Forst. f. Prodr. 34, n. 196, 1786.

Gaultheria erecta Banks et Solander MSS. et Ic.
Gaultheria fluviatilis A. Cunn. in Ann. Nat. Hist. 2; 49, n. 419, 1839.
Gaultheria epiphyta Col. in Trans. N.Z. Inst. 22; 474, 1890.
Brossaea antipoda (Forst. f.) O. Kuntze, Rev. Gen. 388, 1891.

Usually an erect bushy shrub very variable in size and habit, reaching 2 metres under protection but frequently reduced to 25 cm in exposed situations. Branchlets more or less densely strigose, with or without a fine white pubescence. Leaves alternate, 8–15 x 6–12 mm, petiolate, orbicular,

ovate, or elliptical, membraneous or thick, margins generally serrate, glabrous except for a fine pubescence along the upper surface of the mid-rib. Flowers solitary and axillary, very rarely crowded towards the tips of branchlets forming a leafy raceme. Pedicels up to 6 mm long or more, strigose and/or pubescent. Corolla seldom pubescent within. Fruit red, pink, or white, berry-like, 4–6 mm in diameter.

DISTRIBUTION. Widespread throughout New Zealand. Sea level to 3,500ft.

This species hybridises with almost every other species of *Gaultheria* and *Pernettya* with which it comes into contact, but despite this, and despite the immense variation within the species, it forms a distinct unit. Hooker included under *G. antipoda* a number of varieties, most of which Burtt and Hill regarded as hybrids. Burtt and Hill used no varietal epithets, but subdivided the species into 3 groups, namely:

Group A.

Plants with the white pubescence of the stem conspicuous, and only a few strigose hairs, leaves generally obovate. Distribution: mainly North Island and Nelson-Marlborough.

Group B.

Plants with densely strigose branchlets and little or no pubescence. Leaves generally more orbicular than Group A. Distribution: South Island, extending to Ruahine-Cook District and Mt Egmont.

Group C.

Plants of *G. fluviatilis* Cunn. type with narrow leaves. Distribution: Bay of Islands.

In this study, the following characters have been considered in detail:

(a) *Indumentum of branchlets.* There are three main types:
  (i) a more or less dense covering of appressed reddish setae with little or no pubescence beneath,
  (ii) a mixture of a dense covering of appressed setae and a dense pubescence beneath,
  (iii) a dense pubescence with a scattering of a few appressed setae. Intermediates between type (i) and the others, are uncommon.

(b) *Leaf size.* Leaf size varies considerably (8–15 x 6–12 mm). Two broad groups can be recognised.
  (i) Leaves 11–15 x 8–12 mm.
  (ii) Leaves 8–10 x 6–8 mm.

  There are, however, many intermediates and exceptions, most of the complications arising from the fact that shaded specimens have larger leaves and exposed specimens have smaller leaves. It could be that the specimens with large leaves are ecotypes which tend to grow only with other shrubs or under forest, whereas those with smaller leaves are ecotypes which tend to colonize clay banks and other exposed sites directly.

(c) *Leaf shape.* Leaf shape varies from orbicular to elliptic, or even lanceolate. Large leaves tend to be either orbicular or ovate (sometimes obovate) whereas small leaves tend to be elliptic. In most specimens, the base of the leaf is rounded; but in others, from Coromandel to Wellington, it is often acute, making the leaves elliptic-lanceolate. Hybrids with *G. rupestris* and with *Pernettya macrostigma*, also have leaves of this latter shape. Specimens from Coromandel are often obovate-spathulate.

(d) *Indumentum of pedicel.* This is probably the best character for splitting up the species. There are three types:
(i) pedicel sparsely strigose or glabrous,
(ii) pedicel both strigose and pubescent,
(iii) pedicel pubescent only.

There are a few intermediates between (ii) and (iii) which have practically no setae.

(e) *Presence of hairs on the inside of corolla.* The great majority of specimens have glabrous corollas, but there are a few specimens which have long white hairs on the inside of the corolla. There is no apparent correlation between this and other characters.

(f) *Fleshiness of fruiting calyx.* Probably all true-breeding specimens of *G. antipoda* should have a fleshy calyx in the ripened fruit.
Reasons why the calyx is sometimes not fleshy are:

(i) attack by mites, and
(ii) hybridisation and introgression.

Specimens growing within the range of *G. oppositifolia* often have a tendency to produce fruit without a fleshy calyx, and this is probably due to some form of hybridism with *G. oppositifolia.* This applies also to *G. antipoda* growing within the range of *G. rupestris* var. *subcorymbosa.*

(g) *General habit.* Another quite variable character, but plants of open habitats tend to be about 0.5 metres high and fairly compact, whereas forest plants are usually 1–2 metres high and fairly lax.

On the basis of the above the species divides into three parts, though boundaries are not clear cut and exceptions and intermediates are common.

I. Shrub usually 1–2 metres tall. Leaves large, generally 11–15 x 8–12 mm, orbiculate or ovate, seldom obovate. Stem densely strigose, with or without a sparse pubescence. Pedicels lightly strigose or glabrous, not pubescent.

Throughout Stewart Island and the South Island. North Island: Southern Tararuas, Mt Egmont, Little Barrier Island.

II. Shrub of variable form, 0.5–2.0 metres tall. Leaves generally 10–14 x 8–11 mm, varying in shape from orbicular to elliptic. Stem usually densely strigose, with a dense pubescence. Pedicels pubescent and more or less strigose.

Widespread, especially Auckland and Northland.

III. Usually a small compact shrub up to 1 metre tall. Leaves small, generally 8–10 x 6–8 mm, mostly either elliptic or orbicular. Stem sparsely strigose with a dense pubescence. Pedicel densely pubescent, not strigose.

North Island: Coromandel, Rotorua-Taupo, Wairarapa. South Island: Nelson-Marlborough.

The South Island specimens of this group always have orbicular leaves.

Most of the specimens that do not fall into one of the above groups are found between Coromandel and Wellington, mainly on the eastern side of the island. These specimens usually have an acute base to the leaf.

Hybrids of *G. antipoda* are sometimes male-sterile, but it is doubtful whether the true species ever is. If so, it is not to any great extent.

Gaultheria depressa Hook. f. in Lond. Journ. Bot. 6; 267, 1847.

Gaultheria antipoda var. *depressa* Hook. f. Fl. N.Z. 1; 161, 1854.
Gaultheria antipoda Benth. Flor. Austr. 4; 140, 1869.

A small depressed or prostrate shrub. Branchlets up to 20 cm long with usually only the terminal 5 cm leafy, strigose. Leaves alternate, often bronze-coloured, 6–10 x 3–8 mm thick, margins crenulate or bluntly serru-

late, both surfaces glabrous, veins conspicuous. Flowers solitary and axillary. Pedicels usually very short, about 1 mm long, strigose, but usually completely concealed by the bracts. Corolla usually pubescent within. Fruit red, pink, or white, 8–12 mm in diameter.

var. **depressa**

Branchlets usually trailing, strigose but not pubescent. Leaves orbicular or sub-orbicular, apex obtuse, teeth armed with long, persistent bristles up to 2 mm long. Pedicels strigose only.

DISTRIBUTION. Southern Tararuas, along the western side of the Southern Alps, and near Dunedin. Usually in the sub-alpine tussock grasslands. Flowers November-February.

var. **novae-zealandiae** D. A. Franklin var. nov.

Ramuli strigosi saepe sparse brevissime pubescentes. Folia obovata ellipticave, apice acutiusculo marginibus obtuse serratis, dentes setis deciduis armati, venis conspicuis. Pedicelli strigosi pubescentesque.

Branchlets often forming dense matted patches, more or less strigose and often with a sparse very short pubescence. Leaves 6–9 x 3–6 mm (sometimes smaller in exposed plants), obovate to elliptic, apex usually acute, margins bluntly serrate, teeth sometimes armed with bristles when very young, but bristles deciduous leaving short spikes, veins very conspicuous, usually impressed. Pedicels usually both strigose and pubescent.

TYPE SPECIMEN. Lodged in the Dominion Museum, sheet WELT 5367.

TYPE LOCALITY. Renata Peak, Southern Tararuas.

DISTRIBUTION. Common in tussock grassland from the Volcanic Plateau southwards. Sea level 5,000ft, but usually sub-alpine. Flowers November-February.

Hooker's original specimens were from Tasmania. In Fl. N.Z. he reduced his species to a variety of *G. antipoda*, quoting specimens collected by Bidwell and by Lyall in South Island mountains. Cheeseman (1925) reinstated *G. depressa* as a species, giving a description wide enough to cover both varieties. Burtt and Hill followed Cheeseman.

G. depressa is distinguished from *G. antipoda* by its small size, small leaves, and large fruit. The widespread var. *novae-zealandiae* is separated from var. *depressa* by only minor differences, yet in certain localities it is connected by intermediates with *G. antipoda*. The specimen illustrated by Burtt and Hill (Fig. 4) appears to be one of the rare intermediates between the two varieties of *G. depressa*.

PERNETTYA

Pernettya macrostigma Col. in Trans. N.Z. Inst. 21; 92, 1888.

Gaultheria antipoda var. *microphylla* Hook. f. Fl. N.Z., 1; 161, 1854 p.p.
Gaultheria depressa var. *microphylla* (Hook. f.) Cheeseman, Man. N.Z. Fl. (ed. 2), 690, 1925.
Gaultheria perplexa T. Kirk in Trans. N.Z. Inst. 29; 538, 1897, nomen nudum. Cheeseman, Man. N.Z. Fl. (ed. 1), 406, 1906.

A small low shrub, usually prostrate and matted but sometimes forming a bush up to 1 metre tall, branches flexuous and often much interlaced. Branchlets with a more or less dense pubescence and a scattering of long, weak setae. Leaves rather distant, alternate, 6–12 x 1–1.5 mm, distinctly petiolate, linear, often rolled and strongly recurved, thick, glabrous and shiny, margins with up to six indistinct teeth on either side usually in opposite pairs and sometimes bristle-pointed. Flowers solitary and axillary. Pedicels up to 2 mm long, rarely more, glabrous, with 4, 6 or more decussate bracts at the base; bracts ovate, margins densely ciliate, inner surface glabrous. Margins of calyx ciliate, inner surface pubescent. Corolla glabrous or sparsely pubescent within. Stamens not as long as the style,

filaments 1.0–1.2 mm long, dilated near the base to almost 0.4 mm wide but then narrowed again below, densely papillose. Anthers about 0.8 mm long with awns up to 0.4 mm long. Fruit a globose berry 5 mm in diameter, usually bright red, seated in the persistent calyx which either remains unchanged, or becomes enlarged and fleshy in the tube portion only.

DISTRIBUTION. Mountainous regions from Lake Taupo to Stewart Island, often very local. 2,000–5,000ft but descends to sea level in Stewart Island, where it is more inclined to be a bush. Flowers November-January.

This species is quite distinct with its linear leaves, but is none the less closely allied to *P. nana* from which it differs in size and habit, leaf size and shape, and shape of the filaments.

Colenso described *P. macrostigma* from a small specimen of the pure species, which would have been included in *G. antipoda* var. *microphylla* by Hooker. Cheeseman using Kirk's name *Gaultheria perplexa,* noted " capsule usually included in the enlarged and fleshy calyx lobes, . . . but frequently the calyx remains dry and unaltered ". Burtt and Hill, in discussing the fleshy calyx in the fruit, stated that the species is too uniform and widespread to be considered a *Gaultheria* x *Pernettya* hybrid. They then described the leaves as about 0.8– 1 cm long and 0.4 cm broad, and the fruiting calyx as fleshy. From this, it is apparent that they were including hybrids. Furthermore, their illustration shows stamen filaments of the kind usually found in *P. nana* hybrids.

P. macrostigma hybridises freely with many species of *Gaultheria* and hybrids of different parental origin often look very similar. Most have linear-lanceolate leaves which are much broader than those of *P. macrostigma,* and without field evidence it is often very difficult to determine what parents are involved; about half the herbarium specimens examined are hybrids of doubtful parentage.

Male sterility is common.

Pernettya alpina D. A. Franklin sp. nov.

Fruticulus depressus, vage ramosus, ramulis prostratis, radicantibus, ramulis ascendentibus dense puberulis. Folia alterna breviter petiolata, elliptica elliptici-oblongave, crassa coriaceaque, glabra, vix serrata. Flores solitarii, plerumque terminales, brevissime pedicellati, calycis lobis integris marginibus membranaceis. Stamina stylum aequantes, filamentis laevibus basim latissimis, antherae inaristatae.

A small creeping densely matted much-branched shrub, with erect leafy branchlets up to 5 cm long, but mostly less than 3 cm, densely and very minutely puberulous. Leaves alternate, 3–7 x 2–4 mm, shortly petiolate, elliptic or elliptic oblong, extremely thick and coriaceous, almost entire or with 3–4 obscure teeth on either side, glabrous and shining, veins conspicuous. Flowers large and solitary, terminal or both terminal and axillary. Pedicels less than 1 mm long, minutely puberulous, with 2–4 bracts at the base. Bracts broadly ovate, up to 1.5 mm long. Margins of calyx lobes entire and membraneous, inner surface minutely puberulous. Corolla sparingly pubescent within. Stamens as long as the style, filaments 2 mm or more long, ribbon-like, 0.1 mm wide, gradually expanding towards the base, not papillose. Anthers 0.5–0.6 mm long, opening by minute terminal flaps and clefts down the sides, apparently awnless.

TYPE SPECIMEN. Lodged in the Dominion Museum, sheet WELT 5366.

TYPE LOCALITY. Frew's Saddle, Hokitika River, Westland.

DISTRIBUTION. Southern Alps above 4,000ft, usually on the western side only. Also recorded from the Rock and Pillar Range, Otago, and from the N.W. Ruahines (N.I.) at 5,500ft. Flowers December-February.

This species is closely allied to *P. nana,* in which it has probably always been included in the past, but it differs from the latter species in having a more compact

habit, larger and more robust leaves, the calyx segments membraneous and entire, and the anther cells apparently awnless. In addition it is most often found in alpine meadows, whereas *P. nana* is usually confined to sub-alpine valleys.

Pernettya nana Col. in Trans. N.Z. Inst. 23; 389, 1891.

Pernettya tasmanica Hook. f. Handb Fl. N.Z. 1; 176, 1864.
Pernettya tasmanica var. *neo-zealandica* Kirk in Trans. N.Z. Inst. 27; 351, 1895.

A small shrub of matted growth, main stems slender, prostrate and rooting, with ascending tips up to 5 cm long, but usually about 2 cm long. Branchlets glabrous or with a short dense pubescence. Leaves rather distant, alternate, 2–4 x 0.5–1.5 mm, shortly petiolate, elliptic or linear-elliptic, usually thick but not excessively so, margins with up to three microscopic dentations on either side, glabrous or with a dense pubescence on the upper surface, veins prominent. Flowers large, axillary and terminal. Pedicels up to 3 mm long, glabrous or nearly so, usually with two small basal bracts and two larger upper ones. Bracts ovate, margins ciliate. Margins of calyx ciliate, inner surface pubescent. Corolla glabrous within. Stamens as long as the style and nearly exserted. Filaments ribbon-like, 0.1 mm wide, gradually widening to 0.3 mm at the base, not papillose. Anthers 0.4–0.6 mm long with distinct blunt awns about 0.1 mm long. Fruit a pink globose berry 4–5 mm in diameter, seated in the persistent unchanged calyx.

DISTRIBUTION. North Canterbury: Catchment of the Waimakariri. Specimens from here are quite variable. South Canterbury: Tasman Valley, Lake Pukaki to Lake Ohau, also extending to the Hakataramea Pass, relatively large plants. Otago: From north of Lake Wakatipu through to the Old Man Range, small plants. 2,000–3,000ft, but higher in Otago. Flowers December-February.

This, the smallest member of the family in New Zealand, was first included under the name *P. tasmanica* by Hooker, though he remarked (1864) that it was different from the Tasmanian species. Cheeseman (1906) used Colenso's name *P. nana*, and although all of the localities he listed are within the range of true *P. nana*, his description of the leaves "1/6–1/4in long, . . . very thick" is quite erroneous. Burtt and Hill also described the leaves as "3–6 mm long and 1–2 mm broad" and stated that the fruiting calyx was fleshy. Apparently both descriptions included the hybrid *P. nana* x *G. depressa* var. *novae-zealandiae* which is common in the Broken River Basin and probably elsewhere.

P. nana is commonly male-sterile, but because of its matted nature and the size of the plants, it is hard to say to what extent. Probably about one-third are male-sterile but collections examined have always been either wholly hermaphrodite or wholly male-sterile, never a mixture.

GAULTHERIA HYBRIDS

Hooker (1864) suggested the occurrence of natural hybrids among the New Zealand Ericaceae when he described his var. ϵ of *G. rupestris* as "? A hybrid between *rupestris* and *antipoda*". This was subsequently shown by Burtt and Hill to be the hybrid he suggested. Cheeseman made no reference to this hybrid, but noted under *G. fagifolia* Hook. f.: "This appears to me a mere form of *G. rupestris* verging towards *G. oppositifolia*, or possibly a hybrid between the two plants." More probable parents are *G. antipoda* and *G. oppositifolia*, between which the type of *G. fagifolia* occupies an intermediate position.

In 1934 Cockayne and Allan listed six hybrids, two of them with *Pernettya macrostigma* as one parent, and three of them now well known (*G. antipoda* x *G. oppositifolia, G. antipoda* x *G. rupestris, G. depressa* x *G. rupestris*); the sixth, listed as *G. oppositifolia* x *G. rupestris*, was probably based on some form of what was later described as *G. paniculata*, or a hybrid with that species as one parent.

Burtt and Hill recognised, besides the three well known hybrids mentioned above, *G. antipoda* x *G. colensoi, G. antipoda* x *G. paniculata,* and *G. paniculata* x *G. oppositifolia.*

The hybrid *G. antipoda* x *G. oppositifolia* is found throughout the range of *G. oppositifolia.* Other common hybrids are *G. antipoda* x *G. depressa* var. *novae-zealandiae, G. antipoda* x *G. rupestris* var. *subcorymbosa,* and *G. crassa* x *G. depressa* var. *novae-zealandiae.* In each of these cases, the parents involved are widespread and their altitudinal and ecological ranges overlap considerably (see Fig. 3).

Some hybrid populations are so uniform that it would probably be more correct to regard them as examples of introgression of one species into another. For instance, *G. antipoda* populations growing in proximity to *G. rupestris* var. *subcorymbosa,* nearly always have an acute base to the leaf—a characteristic feature of *G. rupestris*—although hybrids might not be evident.

G. antipoda x G. colensoi

A not uncommon hybrid found only on the Volcanic Plateau, and extreme forms of which are relatively easy to detect.

A good example is CHR 95329 which has the thick leaves, terminal inflorescence and dense pubescence of *G. colensoi,* but the presence of bristles on the stem, the shape of the leaves, and the fleshy calyx all point to it being a hybrid with *G. antipoda.* CHR 62415 from the Rangitaiki plains looks superficially very much like *G. antipoda,* but there is a tendency for the solitary flowers to form terminal racemes and the leaves to be very thick. In addition the pedicels are pubescent only, and the fruit has a dry calyx, showing that it is a hybrid with a strong bias towards *G. antipoda.* The hybrid has been frequently collected, and shows great variation in characters.

Many specimens have a fleshy calyx which could almost equally well have come from *G. antipoda* or *G. depressa* var. *novae-zealandiae,* a fact perhaps not realised by Burtt and Hill when they placed a Hooker specimen as *G. antipoda* x *G. colensoi.*

G. antipoda x G. crassa

Not uncommon hybrid found locally throughout the South Island. There are many good examples in both the Dominion Museum and Botany Division herbaria. An excellent example is WELT 6551 from Lake Wakatipu shore, which has the typical leaf size and shape of *G. antipoda,* and the calyces in the fruit often fleshy. However, the leaves are excessively thick and the fruits are in crowded racemes. Other specimens show much the same pattern, flowering ones usually having a densely pubescent corolla.

G. antipoda x G. depressa var. depressa

A rare and doubtful hybrid. Sheet CHR 573 shows four specimens from Lake Harris, near Lake Wakatipu. One is an odd form with obovate leaves, the margins of which are deeply crenate. Of the other three specimens, one is the normal South Island form of *G. antipoda,* another is *G. depressa* var. *depressa,* and the third is an intermediate form. In the intermediate form, the leaves are variously shaped, the margins are seto-ciliate, and the fruit varies in size from that of *G. antipoda* to that of *G. depressa.* It is with some reserve that the hybrid is proposed on this specimen alone.

G. antipoda x G. depressa var. novae-zealandiae

A common hybrid on the Volcanic Plateau, Mt Egmont, Arthur's Pass, and Fiordland. The parents differ only in size and habit, size and thickness of the leaves, and size of the fruit. *G. antipoda* is usually a lowland species whereas the other is more often montane, but they sometimes occur together as distinct entities without intermediates—e.g., on Mt Matthews, near Wellington. However, in the

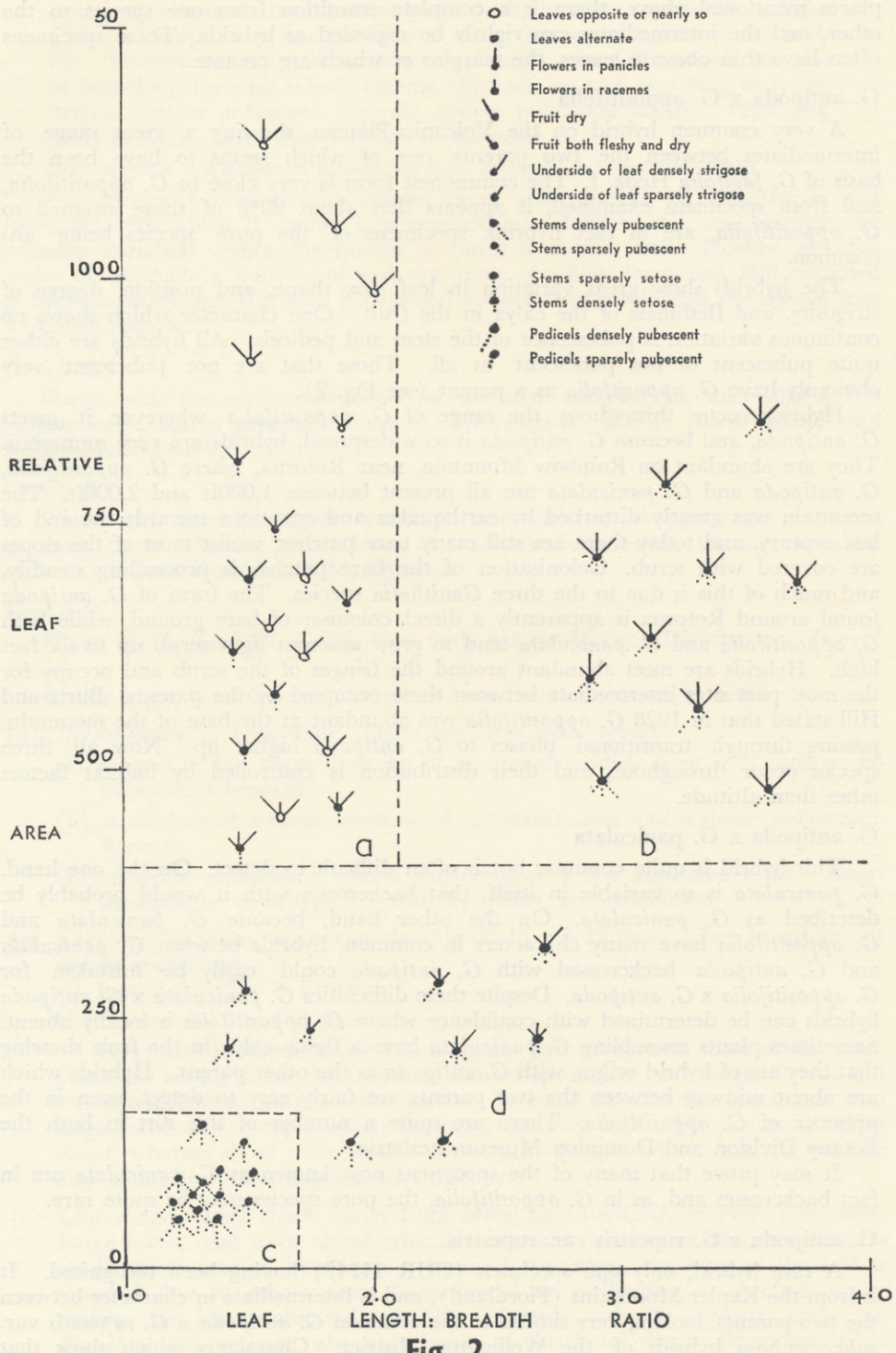

Fig. 2

FIG. 2.—A typical scatter diagram of *Gaultheria* species growing on Rainbow Mountain, Rotorua. (a) Range of *G. oppositifolia* including close hybrids. (b) Range of *G. paniculata.* (c) Range of *G. antipoda* (in this area). (d) Various hybrids.

places mentioned above, there is a complete transition from one species to the other, and the intermediates can rightly be regarded as hybrids. These specimens often have thin obovate leaves, the margins of which are crenate.

G. antipoda x G. oppositifolia

A very common hybrid on the Volcanic Plateau, showing a great range of intermediates between the two parents, one of which seems to have been the basis of *G. fagifolia* Hook. f. The commonest form is very close to *G. oppositifolia,* and from specimens examined, it appears that about 90% of those assigned to *G. oppositifolia,* are in fact hybrids, specimens of the pure species being uncommon.

The hybrids show great variation in leaf size, shape, and position, degree of strigosity, and fleshiness of the calyx in the fruit. One character which shows no continuous variation is pubescence of the stem and pedicels. All hybrids are either quite pubescent or not pubescent at all. Those that are not pubescent very obviously have *G. oppositfolia* as a parent (see Fig. 2).

Hybrids occur throughout the range of *G. oppositifolia* wherever it meets *G. antipoda,* and because *G. antipoda* is so widespread, hybrids are very numerous. They are abundant on Rainbow Mountain, near Rotorua, where *G. oppositifolia, G. antipoda* and *G. paniculata* are all present between 1,000ft and 2,000ft. The mountain was greatly disturbed by earthquakes and eruptions towards the end of last century, and today there are still many bare patches, whilst most of the slopes are covered with scrub. Colonisation of the bare patches is proceeding steadily, and much of this is due to the three *Gaultheria* species. The form of *G. antipoda* found around Rotorua is apparently a direct coloniser of bare ground, while both *G. oppositifolia* and *G. paniculata* tend to grow amongst light scrub up to six feet high. Hybrids are most abundant around the fringes of the scrub and occupy for the most part sites intermediate between those occupied by the parents. Burtt and Hill stated that in 1928 *G. oppositifolia* was abundant at the base of the mountain, passing through transitional phases to *G. antipoda* higher up. Now all three species occur throughout, and their distribution is controlled by habitat factors other than altitude.

G. antipoda x G. paniculata

This hybrid is quite common but is often difficult to detect. On the one hand, *G. paniculata* is so variable in itself, that backcrosses with it would probably be described as *G. paniculata.* On the other hand, because *G. paniculata* and *G. oppositifolia* have many characters in common, hybrids between *G. paniculata* and *G. antipoda* backcrossed with *G. antipoda* could easily be mistaken for *G. oppositifolia* x *G. antipoda.* Despite these difficulties *G. paniculata* x *G. antipoda* hybrids can be determined with confidence where *G. oppositifolia* is locally absent. Sometimes plants resembling *G. paniculata* have a fleshy calyx in the fruit showing that they are of hybrid origin, with *G. antipoda* as the other parent. Hybrids which are about midway between the two parents are fairly easy to detect, even in the presence of *G. oppositifolia.* There are quite a number of this sort in both the Botany Division and Dominion Museum herbaria.

It may prove that many of the specimens now known as *G. paniculata* are in fact backcrosses and, as in *G. oppositifolia,* the pure species may be quite rare.

G. antipoda x G. rupestris var. **rupestris**

A rare hybrid, only one specimen (CHR 11147) having been recognised. It is from the Kepler Mountains (Fiordland), and is intermediate in character between the two parents, looking very similar to the common *G. antipoda* x *G. rupestris* var. *subcorymbosa* hybrids of the Wellington district. Characters which show that *G. rupestris* is one parent are the calyx dry and unaltered in the fruit, and the

lanceolate leaves strigose beneath. *G. antipoda* characters are the solitary fruit and small thin leaves.

G. antipoda x G. rupestris var. subcorymbosa

This hybrid is quite common and can be found on the hills around Wellington and throughout the southern Tararuas up to 3,500ft, the altitudinal limit of *G. antipoda.* Hybrids show a variety of combinations of the parental characters, varying from *G. antipoda* to an intermediate form, but there is no gradation from this to *G. rupestris* var. *subcorymbosa.* This suggests that the F_1 is probably not very self-fertile but can backcross to *G. antipoda.*

Hybrids generally have thin leaves of variable shape and size, flowers in small racemes, and the fruit a mixture of dry and fleshy calyces. Burtt and Hill recognised specimens of this type as hybrids.

G. colensoi x G. depressa var. novae-zealandiae.

This hybrid is common around the bases of the mountains on the Volcanic Plateau, and is well represented in the Dominion Museum herbarium. Plants are usually small, inclined to be procumbent, with small thick leaves, stems variably strigose, flowers solitary or in terminal racemes and the fruit with or without a fleshy calyx. These can only be distinguished from *G. colensoi* x *G. antipoda* by the small size and small leaves.

G. colensoi x G. paniculata

A very doubtful hybrid. In the Dominion Museum there is one specimen in which the lower leaves are elliptic-orbicular, similar to those of *G. colensoi* but slightly more pointed, while those nearer the tips are oblong-lanceolate. All leaves are very thick and the branchlets are pubescent and sparsely strigose. The specimen definitely has some characters of *G. colensoi,* but whether *G. paniculata* is the other parent is a matter of some doubt.

G. crassa x G. depressa var. depressa

An uncommon hybrid seen two or three times on the west coast of the South Island in sub-alpine scrub. On the steeper slopes at high altitudes, scrub and tussock grassland species often intermix, and it is in these regions that the hybrid occurs. The variation is very similar to that found in *G. crassa* x *G. depressa* var. *novae-zealandiae* but in this case the bristles on the margins of the leaves may be only partly persistent. Variety *depressa* is the only *Gaultheria* common in the tussock grassland west of the main divide, var. *novae-zealandiae* being absent.

G. crassa x G. depressa var. novae-zealandiae

This hybrid is apparently quite common in the foothills of Canterbury and is especially plentiful in the Broken River basin. *G. depressa* var. *novae-zealandiae* normally grows out amongst the tussock and *G. crassa* in the scrub. Where the two habitats overlap, hybrids are often found and show every gradation from one species to the other, especially in the size and thickness of the leaves, the size of the racemes, and the fleshiness of the calyx in the fruit. Many plants having small racemes with some calyces fleshy and others quite dry.

Burtt and Hill recorded specimens from Flagstaff Hill, Dunedin, and elsewhere in Otago, but did not mention Canterbury.

G. crassa x G. rupestris var. rupestris

The only reliable characters that separate these species taxonomically are the size, shape, and thickness of the leaves, and whether or not they are strigose. The species are usually very well segregated altitudinally but some specimens collected

from South Westland and Fiordland at altitudes of 1,000–2,000 feet, have characters which are intermediate between those of the two species. These plants are not common and are probably hybrids.

G. oppositifolia x G. paniculata

This is apparently an uncommon hybrid, though it is difficult to detect, as the only reliable characters that separate these species are the shape of the leaves, and whether or not they are opposite (see Fig. 2). Amongst specimens collected near Raurimu, where both parents are present, some have leaves at the base which are typical of *G. oppositifolia,* while those at the tips are typical of *G. paniculata.* In addition to these there is in the Dominion Museum a collection by Attwood from near Raetihi. One specimen has large leaves, many of which are identical with those of *G. paniculata,* the others being somewhat broader. However, the leaves are opposite or sub-opposite proving beyond doubt that it is *G. oppositifolia* x *G. paniculata.*

Burtt and Hill recorded one specimen of this hybrid from leaf shape alone, and it may be possible that some very broad-leaved specimens referred to *G. paniculata* are in fact hybrids. Some specimens of *G. oppositifolia* have elongated leaves, but the length is never three times the width, as it commonly is in *G. paniculata.*

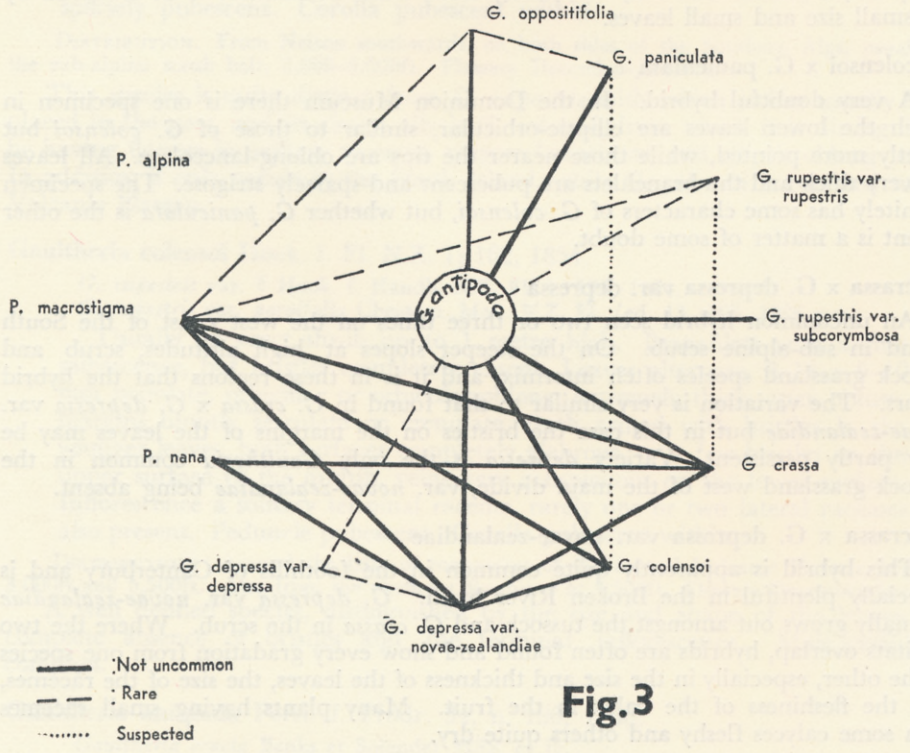

FIG. 3.—Diagram showing the occurrence of hybrids. Note the central position of *G. antipoda,* the most widespread species.

PERNETTYA HYBRIDS

In 1934, Cockayne and Allan listed under other names the hybrids *P. macrostigma* x *G. antipoda* and *P. macrostigma* x *G. depressa* var. *novae-zealandiae,* but because *P. macrostigma* was called *G. perplexa* at that time, they were not then

considered to be bigeneric hybrids. Burtt and Hill recognised these two as hybrids and in addition listed three more; *P. macrostigma* x *colensoi, P. macrostigma* x *G. crassa,* and *P. nana* x *G. crassa.* Three more *Pernettya* hybrids are described here, one of which (*P. nana* x *G. depressa* var. *novae-zealandiae*) is quite common, especially in the catchment of the Waimakariri, the other two rare, each being described from a single collection only.

Although the three species of *Pernettya* in New Zealand are quite distinct, they nevertheless have many characters in common. Because of this, it would be virtually impossible to distinguish hybrids between *Pernettya* species, from *Pernettya* x *Gaultheria* hybrids. With *Pernettya* x *Gaultheria,* it is often very difficult to determine what species of *Pernettya* is involved. This is especially the case around the Broken River Basin and Springfield areas in Canterbury. However, in most cases, there is only one *Pernettya* in the area and the parent species can be determined in this way.

P. macrostigma x G. antipoda

Probably most of the *Pernettya macrostigma* hybrids found, have *G. antipoda* as the other parent. Both species are widespread and opportunities for hybrids to occur are frequent. Because the parents are about the same size and have solitary flowers, the range of hybrids is not very great. Most have an intermediate leaf shape (lanceolate), the leaves being thick or thin, and the fruit a berry seated in the fleshy calyx. Because *P. macrostigma* has linear leaves, most hybrids with it have lanceolate leaves, and *G. antipoda* hybrids can only be distinguished from others when they have thin leaves, and the calyx fleshy in the fruit. Many specimens of pure *P. macrostigma* have the calyx dry and unaltered in the fruit, and probably most specimens with the fruit a berry and the calyx fleshy show introgression from either *G. antipoda* or *G. depressa* var. *novae-zealandiae.*

Burtt and Hill also recognised this hybrid as being quite common, but stated " The fruits as a rule have the calyces very little swollen, sometimes hardly at all ". This is difficult to understand, especially in view of the fact that they described *P. macrostigma* as having the fruiting calyx fleshy.

P. macrostigma x G. crassa

This is quite a common hybrid, especially in the foothills of Canterbury, but is often hard to distinguish from the hybrid *G. crassa* x *P. nana,* which can be macroscopically identical. There is, however, in the Botany Division herbarium, an unnumbered collection by H. Talbot which shows a clear series from one parent to the other. Gradations from one species to the other in vegetative characters such as size, habit, indumentum and leaves are matched by gradations in the flower characters such as type of inflorescence and pubescence of corolla.

Other specimens of this hybrid have been collected from Nelson to Lake Te Anau.

P. macrostigma x G. colensoi

This hybrid is not uncommon on the Volcanic Plateau, and can best be distinguished at high altitudes where there are few species present. A good example is CHR 35059 from the slopes of Ngauruhoe. This specimen has the berries and elongated leaves of *P. macrostigma,* but the terminal racemes, thick leaves, and almost complete absence of hairs, point to its being a hybrid with *G. colensoi.* Many specimens that do not have terminal racemes can easily be confused with *P. macrostigma* x *G. depressa* var. *novae-zealandiae.*

Burtt and Hill described this hybrid from a specimen of Colenso's with the MS. name *G. neglecta.*

P. macrostigma x G. depressa var. **novae-zealandiae**

This was recognised by Burtt & Hill as a not uncommon hybrid, and although it is most common on the Volcanic Plateau, it is also found locally throughout the South Island, especially in Nelson province, near Springfield (Canterbury) and on Flagstaff Hill (Dunedin). Collections normally show a complete gradation from one species to the other, but some populations are intermediate in character and reasonably uniform throughout.

P. macrostigma x G. oppositifolia

A rare hybrid known only from a single collection. Sheet CHR 62412 from the Rangitaiki Plains shows a number of specimens, all very similar. The stems are glabrous, or pubescent with a few bristles, and the leaves are very shortly petiolate, lanceolate, and very often truncate, up to 20 x 5 mm. Some specimens have opposite leaves and the flowers solitary or in a terminal raceme. The fruit is a berry surrounded by the unchanged calyx. The opposite leaves, with very short petioles and truncate bases show the influence of *G. oppositifolia,* and this is substantiated by some specimens with terminal racemes tending to have glabrous branches.

P. macrostigma x G. rupestris var. **rupestris**

This is also a very rare hybrid. In the Botany Division herbarium there is a series of specimens collected at Lake Brunner (near Greymouth) by W. McKay, and including a specimen of each of *G. antipoda, G. rupestris* and *P. macrostigma.* In addition to these, there are three specimens, 60327, 60328, 60329, which are clearly *P. macrostigma* x *G. rupestris. G. rupestris* characters are (1) size of leaves—up to 30 x 5 mm wide, (2) inflorescence of axillary racemes, (3) leaves partly strigose beneath and sometimes on the upper side of the midrib and (4) fruit a capsule. *P. macrostigma* characters are (1) the linear leaves, (2) the small racemes with numerous bracts and (3) in 60329, the straggling habit.

There are also two other specimens (60331, 60332) in this series, similar to the above but with the fruit a solitary berry with a fleshy calyx. These tend to have smaller and more rounded leaves and are probably *P. macrostigma* x *G. antipoda.*

P. nana x G. crassa

A fairly common hybrid especially in the foothills of Canterbury. Specimens have been noted throughout the range of *P. nana* and beyond. From this, it seems that either *P. nana* is a little more widespread than is known at present or that the hybrid is fertile and vigorous, or both.

CHR. 93461 and CHR 96350 from Broken River are both undoubtedly this hybrid. Characters which show that *P. nana* is one parent are the small size and shape of the leaves, the small habit, the almost complete absence of bristles on the stems and the very distinctive anther filaments which are only slightly dilated near the base and are barely papillose. That the other parent is *G. crassa* is certain because of the small racemes of flowers, the thick leaves and the corolla pubescent within. There are also many other good specimens in both the Botany Division and the Dominion Museum herbarium, many of which have the flowers in racemes with the ribbon-like filaments of *P. nana.*

Burtt and Hill described a specimen from Mt Earnslaw which is noteworthy in that it is the only time they recorded male sterility.

P. nana x G. depressa var. **novae-zealandiae**

This hybrid is plentiful in the catchment of the Waimakariri River, from Lake Lyndon to the Mingha River and has also been collected in the Tasman Valley.

Hybrids show every gradation from one species to the other, and in the past most have been classified with *P. nana*. Specimens near *P. nana* are commonest, and some only differ from that species in the presence of occasional bristles on the stems and a more robust habit. Some populations are very uniform and could be considered as *P. nana* with introgression of *G. depressa* var. *novae-zealandiae* characters. It is possible that the procumbent habit of some specimens of *P. nana* could be attributed to this source.

Typical hybrids are intermediate in habit and size of leaves, have filaments hardly dilated, and the fruit a berry seated in the fleshy calyx.

ACKNOWLEDGMENTS

In conclusion, I would like to thank the Botany Department of Victoria University of Wellington for the use of their facilities and for the general assistance given, the Botany Departments of the other New Zealand Universities, the Dominion Museum, and the Botany Division, D.S.I.R., for the use of their herbaria. I would also like to specially thank Miss L. B. Moore for all the valuable time and advice that she has given, and members of the N.Z. Forest Service for their co-operation.

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